

EXAMINING VIRTUAL CURRENCIES:

RISKS AND UNCERTAINTIES OF A NOVEL PAYMENT TECHNOLOGY IN INTERNATIONAL DEVELOPMENT

Financial technology (“FinTech”) firms are changing how consumers save, borrow, invest, and make payments. FinTech innovations have led banks to digitize operations, enabled non-banks to establish greater market share, and transformed the economics of financial inclusion. Under the right conditions, digital payments, specifically, have demonstrated the capacity to advance financial inclusion, resilience, transparency, and empowerment.¹ In countries as diverse as Kenya, Colombia, and the Philippines, consumers and small businesses can make payments through an array of regulated digital payment services offered by banks and non-banks alike.

IN THIS BRIEF

- High-level primer on virtual currencies
- Notable capabilities and risks of virtual currencies for international development contexts
- Illustrative scenarios for the future of virtual currencies in international development contexts
- Illustrative ways the development community might account for potential impacts

Virtual currencies have attracted significant interest from policymakers, market actors, and other stakeholders. Virtual currencies go by many labels that do not always correspond to underlying attributes or regulatory treatment (e.g., cryptocurrency, stablecoin, crypto asset, utility token).² Virtual currencies are typically privately issued and not backed by governments. Depending on the design, virtual currencies can exhibit a range of attributes.³ Bitcoin and Ether are among the most widely known among thousands of virtual currencies. So-called stablecoins have also emerged as a type of virtual currency that is less volatile and thus potentially more suitable for day-to-day payments.⁴ Among the most discussed stablecoins is Diem (formerly called Libra), which is not yet active but being developed by an association of companies and other NGOs (including Facebook, Lyft, and Kiva).⁵

THIS EXPLORATORY BRIEF IS INTENDED FOR USAID STAFF AND PARTNERS who might encounter certain novel digital payment technologies through development and humanitarian assistance programming. It discusses the potential impact and risks that virtual currencies might pose for international development. This brief does not advocate for or against any specific financial technology or business model. Nor does it make any statement regarding the efficacy of any regulatory framework to oversee them in emerging and developing economies. For further discussion of the implications posed by distributed ledger technology (DLT), which underpins certain virtual currencies, see the [USAID Blockchain Primer \(2018\)](#). Portions of this brief are lightly adapted from content published in the Primer.

Author: Paul Nelson, Senior Digital Finance Advisor, United States Agency for International Development

Disclaimer: This publication was made possible through support provided by the United States Agency for International Development (USAID). The opinions expressed herein are the author's and do not necessarily reflect the views of USAID.

¹ For example, see: [The Impact of Mobile Money on Poverty](#), Bill and Melinda Gates Foundation (2020); [Evidence Gap Map, Partnership for Finance in a Digital Africa: Emerging Evidence on Financial Inclusion](#), CGAP (2019); [Digital Finance for All: Powering Inclusive Growth in Emerging Economies](#), McKinsey (2016); and [Global Findex Chapter Six: Opportunities for Expanding Financial Inclusion Through Digital Technology](#), World Bank (2018).

² See: [Crypto-assets: Report to the G20 on Work by the FSB and Standard-setting Bodies](#), Financial Stability Board (July 2018); [Customer Advisory: Use Caution When Buying Digital Coins or Tokens](#), CFTC (2018); [Framework for “Investment Contract” Analysis of Digital Assets](#), SEC (2019); [Distributed Ledger Technology Systems: A Conceptual Framework](#), University of Cambridge Center for Alternative Finance (CCAF) (August 2018).

³ See: [Guidance for a Risk-Based Approach to Virtual Assets and Virtual Asset Service Providers](#), Financial Action Task Force (2019).

⁴ See: [Investigating the Impact of Global Stablecoins](#), G7, IMF, and BIS CPPI (October 2019).

⁵ See: [Libra Rebrands to ‘Diem’ in Anticipation of 2021 Launch](#), CoinDesk (2020) and [Facebook-backed Crypto Project Diem to Launch U.S. Stablecoin in Major Shift](#), Reuters (May 2021) (USDC is another so-called stablecoin).

Despite growing global interest in virtual currencies, these novel payment technologies still lack a critical foundation of rigorous evidence that (a) documents the full spectrum of impacts they might have on key public policy objectives (e.g., financial stability, consumer protection) or (b) validates claims of performance and functionality versus traditional forms of digital payment (e.g., e-money). Risks and uncertainties are still in the process of being understood, managed, and mitigated so that these technologies can gain public confidence and adoption.⁶

These risks and uncertainties are important to acknowledge in the context of international development and humanitarian assistance. In these contexts, the *claimed or notional* benefits of virtual currencies may have appeal to some stakeholders as a means to address existing inefficiencies in payment systems or address other objectives. Indeed, many communities in countries where USAID operates lack trust in financial institutions⁷, have a history of being excluded⁸, or must survive without the security offered by stable economic and political institutions.⁹ Critically, for development actors to be able to rely on virtual currency to facilitate transactions, its value has to be well-accepted by the community (assuming any legal or regulatory preconditions that might apply are also satisfied).

I. A HIGH-LEVEL PRIMER ON VIRTUAL CURRENCIES

KEY TERMS AND OVERLAPPING CONCEPTS

No internationally accepted taxonomy yet exists for virtual currencies and similar innovations. Terminology has evolved in recent years. Standard-setting bodies, jurisdictions, and industry may each use different terms to describe the same or similar innovations. One jurisdiction's use of terms (and regulatory treatment) might differ from another jurisdiction's approach. This underscores the importance of examining how a specific term is being used or defined in any given situation. Among the terms that might be encountered to describe a range of loosely-overlapping innovations are: crypto asset, digital asset, cryptocurrency, stablecoin, virtual currency, non-fungible token (NFT), and digital currency.

Solely for purposes of this brief, a **crypto asset** can be understood as a private digital representation of value that typically relies on a combination of cryptography, peer-to-peer networking, and distributed ledger technology (DLT). A **cryptocurrency** can be understood as a *type* of crypto asset that is marketed or intended to serve as a means of payment or store of value. A cryptocurrency might be viewed as a means to facilitate payments, but it can also exhibit other characteristics that may present regulatory implications (e.g., if authorities consider it to be a commodity or security). A non-fungible token can be understood as a unit of data stored on a digital ledger that aims to certify a digital asset as unique and therefore not interchangeable; it is not a unit of currency, but it can represent an asset with monetary value. Finally, a **virtual currency** can be understood as an umbrella term that encompasses a range of non-fiat digital representations of value—i.e., fiat currency substitutes that are neither endorsed nor issued by a government. Thus the term virtual currency can refer to decentralized cryptocurrencies like bitcoin, but also centralized alternatives that might be issued, stored, transacted, or redeemed by a single party.

For more, see: [FATF Report on Virtual Currency Key Terms](#); [FSB Report on Stablecoins](#); [IMF Report on Virtual Currencies](#); and [CPMI Report on CBDCs](#).

⁶ This also applies to DLT, writ large. For example, in the DLT context, the USAID Blockchain Primer urged critical inquiry, first, of whether it is truly relevant or appropriate to a given situation. In-depth pointers on digital writ large can be found in the *Principles for Digital Development*. Also see: *Disruption and Digital Revolution for Whom? Considerations on the Use of Blockchain and Distributed Ledger Technology in Displacement Contexts* Lee (2020); *Blockchain and Distributed Ledger Technologies in the Humanitarian Sector*, Fast and Coppi (2019).

⁷ For example, see: *Financial Inclusion and Trust Issues in Europe, Central Asia*, Klapper and Singer (2016).

⁸ For example, see: *What Excludes Women from Formal Finance in the Arab States?* CGAP (2016); *Financial Diaries with Smallholder Families*, CGAP (2016); *Challenges in Banking the Rural Poor: Evidence from Kenya's Western Province*, Dupas, et al (2016).

⁹ The causes of systemic stress vary (e.g., natural disasters, economic mismanagement, armed conflict, political crisis, pandemic). For example, see: *Cash Crash: Syria's Economic Collapse and the Fragmentation of the State*, COAR (2020); *Covid-19 in Venezuela: How the Pandemic Deepened a Humanitarian Crisis*, CSIS (2020); and *Understanding Vulnerability and Resilience in Somalia, Lwanga-Ntale and Owino* (2020).

Virtual currencies like bitcoin are built on novel technology, a shared database architecture called distributed ledger technology (DLT). The term “blockchain” came to be used to describe the DLT underpinning bitcoin and has since become an informal synonym to DLT.¹⁰ (Not all DLTs employ the same architecture as prototypical blockchains, so DLT is a preferable umbrella term.) With DLT, no single entity stores data or controls updates to the database. The database might contain public records, account balances, or credit histories; transactions might involve remittances or payments in the course of trade; and relationships among non-trusting parties might involve vendors and suppliers, banks and clients, or governments and citizens.

*DLT employs different features than centralized databases in order to reliably protect data from being corrupted, accessed without authorization, stolen, or lost.*¹¹ Among other things, DLT typically achieves this by using: (a) peer-to-peer networking for quickly propagating transactions across the network; (b) cryptography for preventing data forgery/tampering; and (c) a consensus mechanism. The consensus mechanism must be able to tolerate a degree of adversarial interference across the network and offer participants sufficient incentive to process only valid transactions.¹²

Virtual currencies can rely on DLT in open, closed, and hybrid networks. The design of a DLT-based network can have significant implications for its risk profile and related regulatory considerations. In an open setting, anyone can join the network and process transactions in that virtual currency. In an open setting, where participants do not need to disclose their identity, good behavior is typically incentivized through an economic incentive in the form of natively generated assets—a digital token or a cryptocurrency. Bitcoin, for example, is the reward for actors who validate transactions on the Bitcoin blockchain.

Economic incentives aim to enforce discipline by making interference with the network a costly endeavor. Open virtual currencies aim to achieve this in diverse ways. Bitcoin, for example, relies on a method called “proof-of-work” that is highly energy intensive,¹³ whereas Ethereum has been expected to shift to a “proof-of-stake” method that relies less on energy use to maintain security against network abuse.¹⁴ In a closed or permissioned setting, participants are identified and authenticated before being permitted to access data or validate transactions. In closed settings, the lack of anonymity (and thus the ability to enforce contracts, rely on reputations, or resort to the legal system) can enable participants to use less resource-intensive means to validate transactions.¹⁵ This might occur, for example, if a group of banks use a virtual currency that is only accessible to partner banks.¹⁶ In a closed setting like this, the participants might use DLT but not include a digital token to validate transactions.¹⁷

Bitcoin and Ether are two cryptocurrencies that function in an open setting. Yet thousands exist. Bitcoin was among the earliest to demonstrate the functional characteristics of cryptocurrencies when it began in 2009, as an attempt to enable payments without reliance on banks and other traditional intermediaries.

*Virtual currencies typically do not fulfil the traditionally understood economic functions of money, despite relying on terminology associated with money (i.e., being described as a “currency”).*¹⁸ In its modern forms, money is generally understood to fulfill three functions: (1) serve as a store of value; (2) serve as a medium of exchange, and (3) serve as a unit of account. Fiat currencies typically satisfy these functions.¹⁹ Virtual currencies are neither issued nor backed by any government, and El Salvador is so far the lone country to recognize Bitcoin, specifically, as legal tender.²⁰ Similarly, virtual currencies have generally been too

10 See: ‘Blockchain’ Is Meaningless, The Verge (2018); The Path of the Blockchain Lexicon (and the Law), Walch (2017); Consensus-as-a-Service: A Brief Report on the Emergence of Permissioned, Distributed Ledger Systems, Swanson (2015).

11 See: Distributed Ledger Technology Systems: A Conceptual Framework, University of Cambridge Center for Alternative Finance (CCAF) (2018); Blockchains vs Centralized Databases, Greenspan (2016); and How to Spot a Half-baked Blockchain, Greenspan (2016).

12 See: Distributed Ledger Technology Systems: A Conceptual Framework, CCAF (2018).

13 See discussion on this method here: Beyond the Doomsday Economics of “Proof-of-Work” in Cryptocurrencies, BIS Working Paper (January 2019). Also see commentary on the significant environmental downsides of this model, at least in the case of bitcoin’s proof-of-work system, see: Bitcoin Mining Is Bad for the World: The Limited Options for Addressing the Problem, CGD (2021).

14 See: What is Proof-of-Stake? Coindesk (December 2020).

15 See: Consensus-as-a-Service: A Brief Report on the Emergence of Permissioned, Distributed Ledger Systems, Swanson (2015).

16 For example, see: Stellar Builds Instant Money Transfer Network in Nigeria, Finextra (2016).

17 For example, see: Ripple’s Blockchain Cross-Border Payments Network Grows to 300, Ledger Insights (2020).

18 See: Statement on Crypto-Assets, BCBS (2019).

19 A fiat currency is issued by a government and recognized as legal tender. The value of fiat currency is largely based on the public’s faith in the currency’s issuer—the government. Of course, being a fiat currency does not, alone, guarantee that users will consider it to be a suitable unit of account or store of value (e.g., see fiat currencies affected by hyperinflation).

20 See: In a World First, El Salvador Makes Bitcoin Legal Tender, Reuters (2021) and El Salvador President’s Bitcoin Push Casts Shadow Over IMF Efforts, Reuters (2021).

volatile and inefficient for daily transactions.²¹ Not being treated as legal tender and being volatile are just two factors that have limited the number of people willing to use virtual currencies as a primary store of value or unit of account.

Volatility has driven interest in certain virtual currencies—so-called stablecoins—that are purported to be more conducive to payments. These stablecoins employ a spectrum of mechanisms intended to reduce volatility, such as being “backed” and/or “pegged” to the value of another asset or set of assets, such as the U.S. dollar or other virtual currencies.²²

Certain virtual currencies, including stablecoins, may be classified as commodities or securities. For example, stablecoins that are backed or pegged by more than one asset (like a basket of fiat currencies) might exhibit characteristics (and risks) that differ significantly from stablecoins that are only linked to a single asset or controlled by a single algorithm. Virtual currencies can take on new characteristics over time, whether due to network rules being changed by participants, an organic change in usage patterns, or malevolent interference. This malleability can complicate efforts to ensure appropriate oversight, manage risks, and protect users.

II. STAKEHOLDER CURIOSITY IN VIRTUAL CURRENCIES FOR DEVELOPMENT

Among the purported uses of virtual currencies, the following have received attention among stakeholders in international development settings and emerging markets and developing economies (EMDE). However, the suitability of virtual currencies in the following applications remains contested. As authorities advance efforts to enable real-time payment systems, the potential benefits offered by virtual currencies may become available through other traditional forms of digital payment.²³

- ▶ **Faster, cheaper payments**²⁴ – For cross-border transactions, a virtual currency could serve as a bridge between fiat currencies, particularly for currencies that are not widely traded with each other. This could reduce the number of intermediaries involved in any transfer and thus affect the time, fees, and cost involved. Within jurisdictions, a virtual currency might enable FSPs to execute payments among each other without sole reliance on legacy interbank payment systems, including those only accessible to banks.
- ▶ **Financial inclusion**²⁵ – Virtual currencies could offer payments-related services that banks and others are not willing, or able, to offer certain customers. Small FSPs (like microfinance institutions) and other non-bank startups might view virtual currencies as a way to bypass legacy systems controlled by banks in order to reach a broader customer base with payment and lending services.
- ▶ **Alternative means to store funds**²⁶ – In high-inflation environments where the local fiat currency or banks no longer offer viable means to preserve savings, a virtual currency might be viewed as an expedient store of value. A stablecoin, the value of which is not based on the hyperinflationary local fiat currency, might be presented as more suitable for this purpose than for other more volatile, virtual currencies.
- ▶ **Payments in unstable environments**²⁷ – Virtual currencies could facilitate payments in fragile or conflict-affected areas as well as humanitarian crises, where the banking and payments infrastructure is weak, severely disrupted, or nonexistent. Here, virtual currencies might appeal as an alternative means to remit funds, make payments, manage cash-transfer programs, and store funds. Whereas mobile money, for example, relies on the presence of regulated financial intermediaries, an individual could execute a payment using virtual currency with only an Internet connection and wallet on a phone.

Those interested in using virtual currencies must contend with limitations and risks:

21 For example, see: *Virtual Currencies and Beyond: Initial Considerations*, IMF (2016) and: *Why Bitcoin Hasn't Gained Traction as a Form of Payment*, Wall Street Journal (2021).

22 See: *Investigating the Impact of Global Stablecoins*, G7, IMF, and BIS CPMI (2019).

23 For a discussion on real-time payment systems, see: *Fast payments: Enhancing the Speed and Availability of Retail Payments*, BIS CPMI (2016); *Building Faster Better: A Guide to Inclusive Instant Payment Systems*, CGAP (2021).

24 See: *Mastercard, R3 Team Up To Bring Blockchain To X-Border Payments*, PYMTS (2019); *2nd Global Cryptoasset Benchmarking Study*, CCAF (2018); *Investigating the Impact of Global Stablecoins*, G7, IMF, and BIS CPMI (2019); *Enhancing Cross-border Payments: Building Blocks of a Global Roadmap*, BIS CPMI (2020);

25 See: *FinTech Note: The Rise of Digital Money*, IMF (2019); *Distributed Ledger Technology Systems: A Conceptual Framework*, CCAF (2018); *Cryptocurrencies and Blockchain*, World Bank (2018); *Investigating the Impact of Global Stablecoins*, G7, IMF, and BIS CPMI (2019).

26 See: *Can Cryptocurrency Help Venezuela?* CSIS (2018); *Cryptocurrency Could Help Zimbabwe Overcome Its Economic Crisis*, Lwanda (2019).

27 See: *U.S. unfreezing Venezuelan assets to help opposition fight COVID-19*, Guaido, Reuters (2020); *How the Blockchain Can Help Venezuela's Future Recovery*, CSIS (2018); *Why Bitcoin Matters for Freedom*, Gladstein (2018).

- ▶ **Immature technology and governance models**²⁸ – Virtual currencies are still in their infancy. By contrast, modern large-value payment systems and credit card networks, for example, are supported by extensive risk-management frameworks and have developed resilient platforms that can accommodate trillions of dollars' worth of transactions. Issues of maturity apply both to the resilience and scalability of the technologies used to facilitate payments via virtual currencies and to the stability of the governance models that protect the integrity and security of the underlying networks, whether centralized or decentralized. In the case of bitcoin, for example, its energy-intensive mechanism to validate transactions presents notable tradeoffs. In the case of other virtual currencies, despite theoretical resilience and security from some measure of decentralization of networks underlying virtual currencies, evidence suggests that decentralization is not always assured nor sufficient, and motivated actors could, whether for benign or malevolent purposes, roll back or selectively censor payments on a network. By the same token, these technologies and the new intermediaries that manage them must contend with significant cyber and other operational resilience challenges that affect the entire financial sector. This lack of maturity can make pilots or deployments in humanitarian circumstances difficult or unsuitable, since reliability and trust are critical to any payment modality used.
- ▶ **Unresolved regulatory considerations**²⁹ – Authorities in EMDEs are still adjusting legal, regulatory, and supervisory safeguards in order to fully account for the risks and attributes of virtual currencies, as well as the service providers associated with them. Indeed, authorities in EMDEs are still in the process of improving oversight capacity with respect to more traditional financial services. Safeguards relevant to virtual currencies span multiple regulatory domains, and a single virtual currency or its use might implicate multiple, simultaneously. Certain service providers in the virtual currency ecosystem (such as wallet providers or trading platforms) have been slow to comply with regulatory obligations. Notable regulatory domains that might be implicated include securities, anti-money laundering/countering terrorist financing (AML/CFT), payment systems, financial stability, monetary policy, commodities, and derivatives. As regulatory frameworks mature, certain business models common to the virtual currency ecosystem may become unviable.
- ▶ **Used to facilitate fraud and abuse**³⁰ – Consumers who access virtual currencies usually do so via intermediaries. In the absence of appropriate safeguards, intermediaries can expose users to harm. The nature of harm can vary, but it might include fraudulent claims regarding the safety of funds or the nature of custodial measures, the validity of prices quoted on platforms, and the security of platforms. Reports suggest that the scale of ransomware attacks—in which payment is demanded in the form of virtual currencies like bitcoin—have also proliferated over the course of the COVID-19 pandemic. These ransomware attacks have targeted institutions in both developed and developing countries, reportedly at the direction of both state and non-state actors.
- ▶ **Used to facilitate illicit finance**³¹ – Virtual currencies, like the broader financial system, can be exploited by bad actors for money laundering, terrorist financing, sanctions evasion, and other illicit activities. Virtual currencies are not invulnerable to abuse, and indeed, the distributed nature of underlying systems and lack of transparency associated with how they operate can complicate efforts to prevent illicit finance. Certain virtual currency innovations that obscure the source or destination of funds have arisen that undermine the effectiveness of AML/CFT controls. This has been examined by private sector studies (like from RAND) as well as advisories and guidance issued by specific jurisdictions (like by the U.S. Government's FinCEN) and standard-setting bodies (like the Financial Action Task Force). For example, the risk of illicit finance increases when service providers do not conduct adequate customer due diligence, lack sound anti-money laundering compliance programs, or do not maintain records that would facilitate tracking or reporting of suspicious activities. Given the

28 See: *The Blockchain Immutability Myth*, Greenspan (2017); *A Rational Take on Cryptocurrencies*, Greenspan (2017); *Global Cryptocurrency Benchmarking Study*, CCAF (2017); and *Distributed Ledger Technology Systems: A Conceptual Framework*, CCAF (2018); *Have PoW Blockchains Become Less Resource Intensive?* Swanson (2019); and *Bitcoin Mining Is Bad for the World: The Limited Options for Addressing the Problem*, CGD (2021).

29 According to self-assessments submitted to FATF, as of July 2021, only 58 of 128 surveyed jurisdictions reported having implemented revised FATF standards related to virtual assets in local rules, with even fewer having taken steps to operationalize those rules (12 Month Review of Revised FATF Standards - Virtual Assets and VASPs (FATF)). Also see: *Crypto-assets: Report to the G20 on Work by the FSB and Standard-setting Bodies*, Financial Stability Board (2018); *Guidance for a Risk-Based Approach to Virtual Assets and Virtual Asset Service Providers*, Financial Action Task Force (2019); *Global Stablecoin Initiatives: Public Report*, IOSCO (2020); *Regulation of Cryptocurrency in Selected Jurisdictions*, Library of Congress (2018); *Global Cryptoasset Regulatory Landscape Study*, CCAF; *Investigating the Impact of Global Stablecoins*, G7, IMF, and BIS CPMI (2019); *Enhancing Cross-border Payments: Building Blocks of a Global Roadmap*, BIS CPMI (2020); Press Release: New FinCEN Guidance Affirms Its Longstanding Regulatory Framework for Virtual Currencies and a New FinCEN Advisory Warns of Threats Posed by Virtual Currency Misuse, FinCEN (May 2019).

30 See: *Virtual Assets Red Flag Indicators of Money Laundering and Terrorist Financing*, FATF (2020); *Customer Advisory: Beware Virtual Currency Pump-and-Dump Schemes*, CFTC (2018); *Customer Advisory: Understand the Risks of Virtual Currency Trading*, CFTC; Press Release: *Cryptocurrency Fraudster Sentenced*, FBI (2019); Press Release: *FBI Expects a Rise in Scams Involving Cryptocurrency Related to the COVID-19 Pandemic*, FBI (2020); *Ransomware Payments Up 33% As Maze and Sodinokibi Proliferate in Q1 2020*, Coveware (2020); *The Incredible Rise of North Korea's Hacking Army*, The New Yorker (2021); and *Bitcoin Has Lost Steam. But Criminals Still Love It*, The New York Times (2020).

31 See: *Advisory on Illicit Activity Involving Convertible Virtual Currency*, FinCEN (2019); *Terrorist Use of Cryptocurrencies: Technical and Organizational Barriers and Future Threats*, RAND (2019); *Exploring the Use of Zcash Cryptocurrency for Illicit or Criminal Purposes*, RAND (2020); *The Eight Most Popular Cryptocurrency Transaction Types Are Not What You'd Expect*, Forbes (2020).

ease by which cross-border payments can be facilitated using virtual currencies, the ineffectiveness of protections in one jurisdiction can result in risks in another. Both state and non-state actors have reportedly taken advantage of such gaps. This underscores the importance of abiding by applicable standards that address these types of risks, whether the responsibilities affect service providers that facilitate the use of virtual currencies or the authorities tasked with market oversight.

- **Limited utility and adoption**³² – as with any novel innovation, early speculation on how virtual currencies might improve upon the status quo has given way to the realities of implementation. In some cases, the limited adoption of virtual currencies for the purposes outlined above is due to contextual factors (e.g., regulatory issues, limited awareness, or low trust in new technologies or firms). Yet limited adoption can also be due to practical factors, like not yet being able to spend a virtual currency at stores or being able to safely store it. Thus far, reports suggest that the use of virtual currencies appears to be centered on speculative trading and illicit finance, except in more unique circumstances, like families trying to send funds into countries with hyperinflationary local currencies.

III. CENTRAL BANK DIGITAL CURRENCIES

Public sector authorities are examining central bank-issued digital currencies (CBDCs), which should not be confused with privately issued virtual currencies (see sidebar below). A CBDC would be a new form of central bank money, issued and backed by a government. Models being studied vary, but CBDCs are understood to be a form of central bank money that uses digital means to expand access to direct claims on the central bank beyond traditional ones—like physical cash, coins, or settlement accounts held by banks.³³ Intrigue centers upon both retail models, where a CBDC might be treated by consumers in a manner similar to physical cash, and wholesale models, where a CBDC might be used to facilitate payments among banks and other large financial institutions. Internationally, a recent survey found that over 80 percent of central banks, including in key jurisdictions such as Europe and China, are engaged in CBDC research and development.³⁴ The last decade has seen dozens of studies, a few pilots, and so far, a single, live implementation of a CBDC.³⁵

IV. HOW VIRTUAL CURRENCIES MIGHT AFFECT STAKEHOLDERS IN INTERNATIONAL DEVELOPMENT

The ways in which virtual currencies, CBDCs, and other novel payment technologies might affect stakeholders in countries where USAID operates are only beginning to emerge. The long-term impacts remain speculative. With time, the technologies, governance models, and enabling environments for virtual currencies and CBDCs will mature. Risks may subside, others may emerge. As a result, potential impacts will evolve, too. The local enabling environment and market dynamics will have a significant effect on how virtual currencies are adopted, used, or developed. Just as impactful are basic preconditions, like reliable access to electricity, the Internet, and digital literacy. The following scenarios—purely illustrative and not meant to be comprehensive or mutually exclusive—are intended to give a sense of how different circumstances might lead to different outcomes.

Illustrative Scenario 1: Regulatory Frameworks Adjust to Address Virtual Currency Risks and Capabilities

In this scenario, EMDE authorities might update local legal, regulatory, supervisory, and enforcement frameworks to take full account of the opportunities and risks that virtual currencies might pose. These updates might integrate emergent or existing guidance from relevant global standard-setting bodies, like the Financial Action Task Force (FATF) or the Basel Committee on Banking Supervision (BCBS).³⁶ These standards and practices, when locally adopted, would aim to resolve gaps that actors

32 See: Will Digital Currencies Be the Next Revolution in Financial Inclusion? Calabria (2020); The Eight Most Popular Cryptocurrency Transaction Types Are Not What You'd Expect, Forbes (2020); FinTech Note: The Rise of Digital Money, IMF (2019); Digital Currencies and Financial Inclusion: 5 Questions, Mazer (2014).

33 See: Central Bank Digital Currencies, BIS CPMI (2018); FinTech Note: The Rise of Digital Money, IMF (2019).

34 See: Ready, Steady, Go? - Results of the Third BIS Survey on Central Bank Digital Currency, BIS CPMI (2021).

35 Reportedly, the only CBDC that has proceeded beyond the pilot stage is the Bahamian Sand Dollar (see [website](#)). The People's Republic of China is now piloting its own CBDC (a digital yuan) with a small group of consumers, merchants, and government entities. See: China's Digital Currency: Adding Financial Data to Digital Authoritarianism, CNAS (2021).

36 See, for example: Designing a Prudential Treatment for Crypto-assets, BCBS (2019); Sound Practices: Implications of FinTech Developments for Banks and Bank Supervisors,

in the virtual currency ecosystem might otherwise exploit or fall prey to. (For example, [FATF guidance](#) addresses ways in which authorities should address financial integrity concerns related to virtual currencies and associated service providers.) Some authorities might choose to permit local use of virtual currencies but still clarify the circumstances in which such use by service providers would comply with know-your-customer obligations. Other authorities, by contrast, might choose to simply prohibit the local use of virtual currencies, and, consistent with FATF guidance, these authorities might pair that prohibition with enforcement mechanisms. Collectively, these efforts by authorities in EMDEs might have the effect of reducing certain risks posed by virtual currencies. As a result, these efforts might positively affect trust by consumers.

In the marketplace, regulatory clarity as outlined here might contribute to greater investment in the virtual currency ecosystem. The financial sector and investor community might then develop more diverse financial services that use virtual currencies. This might accelerate the rate at which the technologies, governance models, and institutional arrangements in the ecosystem mature. As additional regulated service providers enter the market, consumer-level trust in these services might increase, resulting in more interest in and adoption of virtual currencies for day-to-day needs. So-called stablecoins offered by regulated service providers might also be launched that address specific consumers' needs (e.g., cross-border payments). Illicit financial activity might occur to some degree in the ecosystem, but local authorities might nevertheless have in place the appropriate mechanisms to mitigate the scale and impact of such activity. Over time, rates of illicit activity facilitated by virtual currencies might hold steady or diminish. Certain EMDE authorities might revisit their earlier interest in developing a CBDC. This might happen, for example, if those authorities had earlier considered a CBDC as a sort-of response to the emergence of private stablecoins.

Illustrative Scenario 2: Virtual Currencies Proliferate Amidst Continued Patchwork of Regulatory Regimes

In this scenario, authorities in EMDEs might take divergent approaches in response to the growth of the virtual currency ecosystem. Certain authorities might choose to impose a ban on the local use of virtual currencies, but the ban might not be paired with the necessary mechanisms to enforce it. Other authorities might permit the local use of virtual currencies, but they might not develop an enabling environment that fully applies relevant global standards such as those set by FATF or BCBS. This might then increase risks, such as money-laundering, fraud, and financial market instability. Other authorities might simply lack the institutional capacity or resources to craft and implement whatever local rules they favor. As a result, in such markets, virtual currency might be issued, traded, or used but without sufficient safeguards for users or the broader financial system.

In the marketplace, inadequate regulatory protections might have diverse impacts, driven by local circumstances. In high-inflation environments, for example, consumers and businesses might resort to storing funds or making payments through virtual currencies that might be less volatile than the local fiat currency. For these environments, so-called stablecoins that are not tied to the value of the local fiat currency might become attractive options. Such users, driven by the necessity to preserve wealth, might be willing to use the virtual currency ecosystem notwithstanding a lack of regulatory safeguards. In fragile environments that are isolated from the global financial system—such as those affected by conflict or a collapse in local governmental institutions—households, businesses, and NGOs might resort to using virtual currencies as a means to transfer funds into the country or store local wealth. In an EMDE with weak institutions and a weak fiat currency, the increased use of virtual currencies in the local economy might prompt a cycle of currency substitution (between the local fiat currency and virtual currencies accessible in the jurisdiction); if this occurs at scale, then the EMDE might be ill-equipped to manage corresponding impacts on financial stability and monetary policy.

Meanwhile, the rate of ransomware attacks might increase globally, with attackers successfully exploiting gaps in local regulatory frameworks to launder the virtual currency-denominated proceeds of these crimes, with the perpetrators evading authorities by quickly transferring funds through jurisdictions with inadequate safeguards. Attackers might take advantage of virtual currency platforms and service providers that lack or choose not to set up appropriate systems or policies aligned with FATF guidance. In countries where limited consumer or investor protections exist for end-users, individuals might fall prey to “get rich quick” messaging associated with virtual currencies and so-called “initial coin offerings.” Pump-and-dump

BCBS (2018); and [Guidance for a Risk-Based Approach to Virtual Assets and Virtual Asset Service Providers](#), FATF (2019).

schemes might be facilitated by the use of social media platforms that ensnare unsuspecting consumers. This might cause consumers to lose money, lose trust in other digital financial services, and be exposed to other risks (e.g., if a consumer doesn't realize the initial coin offering is illegal under local securities laws). Finally, virtual currencies might continue to be a desirable channel for illicit finance for both state and non-state actors (e.g., those seeking to launder funds, finance terrorism, or evade sanctions). As with other criminal activity, these actors might exploit unresolved gaps in legal, regulatory, and supervisory frameworks of EMDE jurisdictions; such gaps might enable the use of service providers to obscure the origin, use, and destination of funds.

Illustrative Scenario 3: CBDCs Circulate Alongside Private Virtual Currencies

In this scenario, EMDE authorities in certain countries might choose to study, test, pilot, and then roll out CBDCs (see sidebar for background on CBDCs). These efforts might proceed in parallel to the growth and maturation of the private virtual currency ecosystem. The rationale presented by authorities for CBDCs might vary, as would the readiness of authorities to safely oversee and introduce a CBDC. Certain EMDE authorities, despite having insufficient institutional readiness to manage a CBDC, might nevertheless proceed with one. Certain EMDE authorities might launch a CBDC to facilitate new types of wholesale payments among banks, the central bank, and other large financial institutions. EMDE authorities might also launch a CBDC for retail-level transactions by the public. Finally, EMDE authorities might launch a CBDC to facilitate faster cross-border payments. In certain countries where a CBDC is launched, the authorities might lack a complete understanding of the risks and implications that the CBDC (such as its underlying governance arrangements or technological architecture) might pose to the financial system. Certain impacts on or systemic risks to financial stability, integrity, and inclusion might only become clear as more users or institutions use the CBDC at scale.

In the marketplace, the impacts from the roll out of the CBDCs noted in the above paragraph are difficult to fully anticipate. In EMDEs where a CBDC circulates alongside virtual currencies, a range of factors might influence the circumstances in which one or the other would be favored by the marketplace. This might, for example, depend on the relative convenience or reliability of these alternatives to traditional payment or savings instruments. If a retail-level CBDC is introduced by an EMDE, but without suitable privacy safeguards, the public might instead choose to rely on virtual currency alternatives that disclose less data on private transactions. Certain EMDEs might design a CBDC that intentionally lacks privacy safeguards so that the state can have direct, granular visibility of transactions made by the public. If CBDCs are adopted at scale, certain EMDEs might experience a significant reduction in bank deposits, as balances shift over to CBDC-denominated instruments. This would force the banking sector to develop more robust methods for maintaining the availability of credit in the financial sector.

V. ILLUSTRATIVE WAYS THE DEVELOPMENT COMMUNITY MIGHT ACCOUNT FOR POTENTIAL IMPACTS

The development and humanitarian assistance community might encounter these novel payment technologies with greater frequency as interest in these innovations grows. The illustrative efforts below correspond generally with roles commonly played by the development community in advancing digital development and financial inclusion writ large. As illustrative efforts, these might not be appropriate for all situations. Caution and due diligence can assist the community in determining how best to account for the potential risks and impacts these innovations might have for stakeholders in emerging markets and developing economies (EMDE).

Certain efforts below are more relevant for civil society organizations or donor partners who work with communities that are affected by the presence of virtual currencies or are considering whether to use them. Other efforts below are more relevant for financial service providers or authorities in EMDEs that donor partners might interact with during the course of development or humanitarian assistance programming.

Build an Objective Evidence Base on Impacts, Risks, and Opportunities

- ▶ Encourage stakeholders in EMDEs that are considering whether to study, test, or deploy virtual currencies or other novel payment technologies to first conduct due diligence on potential impacts and risks for the local economy, and assess whether other forms of digital payment can meet the needs of stakeholders without the attendant risks. Among others, devote particular attention to risks related to consumer protection, illicit finance (money-laundering, terrorist financing), and financial stability
- ▶ Urge stakeholders (as relevant) to review, adopt, or abide by existing, revised, or new international standards or guidance that apply to virtual currencies, such as:
 - [FATF Guidance for a Risk-Based Approach to Virtual Assets and Virtual Asset Service Providers](#)
 - [CPMI-IOSCO Principles for Financial Market Infrastructures](#)
 - BCBS Basel Framework standards, such as the:
 - [Principles for the Sound Management of Operational Risks](#)
 - [Basel Core Principles for Effective Banking Supervision](#)
- ▶ Monitor the presence of virtual currencies in EMDEs for their use in or impact on development and humanitarian assistance efforts

Employ a Consultative Approach with Stakeholders

- ▶ Confer with donors, NGOs, authorities, civil society, and other stakeholders when virtual currencies or other novel technologies intersect with development or humanitarian assistance programming
- ▶ Facilitate dialogue to surface insights or experiences from stakeholders on emergent risks posed by virtual currencies and other novel payment technologies in EMDEs. For example:
 - Ransomware attacks targeting local civil society, FSPs, NGOs, and small businesses
 - Use of virtual currencies to facilitate money-laundering or illicit activity in the community
- ▶ Collaborate with industry and civil society to improve public awareness of the risks and characteristics of virtual currencies
- ▶ Support the establishment and donor attendance of working groups or other fora convened by authorities in EMDEs to examine novel payment technologies
- ▶ Understand and document local stakeholder needs, including the underlying circumstances that have prompted interest in virtual currencies. Examine whose needs might not be met, or are even made worse off, by exposure to virtual currencies

Provide Capacity-Building to Apprise Stakeholders of Potential Risks and Impacts

- ▶ Support local institutions and associations to define needs, assets, and local capabilities. Provide technical assistance to stakeholders in EMDEs so that risks and implications of virtual currencies and other novel payment technologies are better understood and accounted for

- ▶ Support cyber security-related capacity-building efforts for organizations, sectors, or individuals that are vulnerable to ransomware
- ▶ Support efforts by authorities and financial service providers in EMDEs to strengthen the local application of applicable global standards and practices. The standards or practices will vary based on the FinTech issue in question, but they might include, for example, the application of the risk-based approach outlined by FATF to address money-laundering and terrorist-financing risks related to virtual currencies or associated service providers (see [FATF Guidance on Virtual Assets and Service Providers](#))
- ▶ Strengthen consumer protection frameworks and mechanisms to identify and resolve promptly consumer complaints or harm arising from novel payment services (e.g., custody of funds, data protection, disclosures, and transparent pricing)
- ▶ Engage local educational institutions to develop and provide capacity-building programs focused on novel payment technologies
- ▶ Support authorities in EMDEs to update national and sectoral ICT strategies to reflect lessons, assets, and capacity gaps that might improve readiness to engage responsibly on novel payment technologies

SIDEBAR ON CBDCs

CBDCs often appear in discussions alongside virtual currencies but present different risks and respond to different issues. CBDCs have been studied for how they might be used in service of many policy objectives—from financial inclusion, to payment system efficiency, to financial stability, to cross-border payments, to monetary policy transmission. Generally, a CBDC is understood as a new form of digital central bank money that could be used, among other things, to provide continued access by the general public to a risk-free central bank payment instrument and to expand access to digital payment services.^a In a sense, CBDCs could be a digital equivalent to physical cash. The system architecture of a CBDC would reflect the policy objectives and functional characteristics required by the central bank.^b CBDCs have been studied and prototyped both with and without a DLT architecture. Similarly, CBDCs have been examined that would operate on a retail basis (accessible to individuals, akin to cash), wholesale basis (accessible only to financial institutions), or a combination of each.^c Depending on the architecture employed, a CBDC might manifest tradeoffs between certain priorities, such as privacy of data associated with transactions and convenient access for end users.^d

Aided by further study and testing, both global standard-setting bodies and others have noted that CBDCs are not merely a slightly different version of money held as an electronic bank deposit or balance in a mobile wallet.^e Rather, CBDCs can affect how the financial system is structured. As such, CBDCs might entail profound changes—how banks provide credit, how payments are made among FSPs, and how monetary policy is conducted by central banks, and how geopolitical considerations evolve.^f Given these potential implications, organizations have highlighted the uncertainties regarding how CBDCs might impact the global financial system, how CBDCs might affect the rise of global stablecoins, and what preconditions must be in place prior to implementing a live CBDC of any type.^g

a [Central Bank Digital Currencies](#), BIS CPMI (2018) and [Central Bank Digital Currencies: Foundational Principles and Core Features](#), BIS, ECB, FRB, et al (2020).

b [Design Choices for Central Bank Digital Currency: A Position Paper](#), Brookings Institution (2020) and [Central Bank Digital Currency, Design Choices, and Impacts on Currency Internationalization](#), CSIS (2020).

c [A Survey of Research on Retail Central Bank Digital Currency](#), IMF (2020).

d [Central Bank Digital Currency, Design Choices, and Impacts on Currency Internationalization](#), CSIS (2020) and [China's Digital Currency](#), CNAS (2021).

e [Central Bank Digital Currencies: Foundational Principles and Core Features](#), BIS, ECB, FRB, et al (2020).

f [Central Bank Digital Currencies](#), BIS CPMI (2018); [Central Bank Digital Currency: an Innovation in Payments](#), R3 (2020); [Enhancing Cross-border Payments: Building Blocks of a Global Roadmap](#), BIS CPMI (2020); and [China Lead's Africa's Digital Currency Race](#), Coindesk (2021).

g [Central Bank Digital Currencies](#), BIS CPMI (2018); [Investigating the Impact of Global Stablecoins](#), G7, IMF, and BIS CPMI (2019); [Preconditions for a General-Purpose Central Bank Digital Currency](#), FED Notes - Federal Reserve Board (2021); and [Contingency Planning for a Central Bank Digital Currency](#), Bank of Canada (2020).

ACKNOWLEDGEMENTS

This exploratory brief benefited immensely from comments, suggestions, and corrections offered by many folks, including Fernando Maldonado, Taha Gaya, Alison Harrell, Molly Dean, Diana Boncheva-Gooey, Jaclyn Carlsen, Josh Woodard, Peter Richards, William Martin, Jared Banks, Andrew Zviridin, Agnes O'Hanlon, Mayada El-Zoghbi, Mehmet Kerse, Estelle Lahaye, Susan Wilder, Bill Butterfield, Moussa Traore, Peter Grills, Craig Jolley, Aubra Anthony, Shachee Doshi, Yaya Fanusie, John O'Bryan, Ashley Faler, Brandon Possin, and a few other unnamed, but much appreciated, expert reviewers. Any errors in this brief are not theirs but mine alone.

REFERENCES

- Adrian, T., Griffo, T. (2019, July). The rise of digital money. International Monetary Fund (IMF) FinTech Note No. 2019/001. <https://www.imf.org/en/Publications/fintech-notes/Issues/2019/07/12/The-Rise-of-Digital-Money-47097>
- Allen, S., Grimmelmann, J., Juels, A., Prasad, E. (2020, July). Design choices for central bank digital currency. Brookings Institution. <https://www.brookings.edu/blog/up-front/2020/07/23/design-choices-for-central-bank-digital-currency/>
- Anderson, J., Ahmed, W. (2016, February). Financial diaries with smallholder families. Consultative Group to Assist the Poor (CGAP). <https://www.cgap.org/research/publication/financial-diaries-smallholder-families>
- Arnold, T., Strohecker, K. (2021, June). El Salvador president's bitcoin push casts shadow over IMF efforts. Reuters. <https://www.reuters.com/technology/el-salvador-presidents-bitcoin-push-casts-shadow-over-imf-efforts-2021-06-07/>
- Auer, R. (2019, January). Beyond the doomsday economics of 'proof-of-work' in cryptocurrencies. Bank for International Settlements (BIS) Working Paper No. 765. <https://www.bis.org/publ/work765.htm>
- Bank of Canada. (2020, February). Contingency planning for a central bank digital currency. <https://www.bankofcanada.ca/2020/02/contingency-planning-central-bank-digital-currency/>
- Bank of Canada, European Central Bank, Bank of Japan, Sveriges Riksbank, Swiss National Bank, Bank of England, Board of Governors of the Federal Reserve, and Bank for International Settlements (BIS). (2020, October). Central bank digital currencies: Foundational principles and core features. BIS Innovation Hub. <https://www.bis.org/publ/othp33.htm>
- Basel Committee on Banking Supervision (BCBS). (2018, February). Sound practices: Implications of fintech developments for banks and bank supervisors. BCBS Sound Practices. <https://www.bis.org/bcbs/publ/d431.htm>
- BCBS. (2019, March). Statement on crypto-assets. https://www.bis.org/publ/bcbs_nl21.htm
- BCBS. (2019, December). Designing a prudential treatment for crypto-assets. BCBS Consultative Paper. <https://www.bis.org/bcbs/publ/d490.htm>
- BIS Committee on Payments and Market Infrastructures (CPMI). (2016, November). Fast payments: Enhancing the speed and availability of retail payments. CPMI Report No. 154. <https://www.bis.org/cpmi/publ/d154.htm>
- BIS CPMI. (2018, March). Central bank digital currencies. <https://www.bis.org/cpmi/publ/d174.htm>
- BIS CPMI (2020, July). Enhancing cross-border payments: building blocks of a global roadmap. CPMI Report No. 193. <https://www.bis.org/cpmi/publ/d193.htm>
- Bill and Melinda Gates Foundation. (2021, April). The impact of mobile money on poverty. <https://www.gatesfoundation.org/our-work/programs/global-growth-and-opportunity/financial-services-for-the-poor/research-brief-the-impact-of-mobile-money-on-poverty>
- Bloomberg, J. (2019, January). The eight most popular cryptocurrency transaction types are not what you expect. Forbes. <https://www.forbes.com/sites/jasonbloomberg/2019/01/19/the-eight-most-popular-cryptocurrency-transaction-types-are-not-what-you-expect/>
- Boar, C., Wehrli, A. (2021, January). Ready, steady, go? Results of the third BIS survey on central bank digital currency. BIS Paper No. 114. <https://www.bis.org/publ/bppdf/bispap114.htm>
- Caesar, E. (2021, April). The incredible rise of North Korea's hacking army. The New Yorker. <https://www.newyorker.com/magazine/2021/04/26/the-incredible-rise-of-north-koreas-hacking-army>
- Calabria, C. (2020, October). Will digital currencies be the next revolution in financial inclusion? FinDev Gateway Blog. <https://www.findevgateway.org/blog/2020/10/will-digital-currencies-be-next-revolution-financial-inclusion>
- Calle, G., Eidan, D. (2020, April). Central bank digital currency innovation in payments. R3 White Paper. <https://www.r3.com/reports/central-bank-digital-currency-an-innovation-in-payments/>
- Center for Operational Analysis and Research (COAR). (2020, July). Cash crash: Syria's economic collapse and the fragmentation of the state. <https://reliefweb.int/report/syrian-arab-republic/cash-crash-syria-s-economic-collapse-and-fragmentation-state-july-2020>

Cheng, J., Lawson, A., Wong, P. (2021, February). Preconditions for a general-purpose central bank digital currency. FEDS Notes. Board of Governors of the Federal Reserve System. <https://doi.org/10.17016/2380-7172.2839>

Cook, W., Lennox, D., Sbeih, S. (2021, January). Building faster better: a Guide to inclusive instant payment systems. CGAP. <https://www.cgap.org/research/publication/building-faster-better-guide-inclusive-instant-payment-systems>

Commodity Futures Trading Commission (CFTC). (2018, July). Customer advisory: Use caution when buying digital coins or tokens. https://www.cftc.gov/LearnAndProtect/AdvisoriesAndArticles/caution_of_digital_currencies.html

CFTC. Customer advisory: Understand the risks of virtual currency trading. https://www.cftc.gov/LearnAndProtect/AdvisoriesAndArticles/understand_risks_of_virtual_currency.html

Coppi, G., Fast, L. (2019, February). Blockchain and distributed ledger technologies in the humanitarian sector. Humanitarian Policy Group and Overseas Development Institute. <https://odi.org/en/publications/blockchain-and-distributed-ledger-technologies-in-the-humanitarian-sector/>

Coveware. (2020, April). Ransomware payments up 33% as Maze and Sodinokibi proliferate in Q1 2020. <https://www.coveware.com/blog/q1-2020-ransomware-marketplace-report>

De, N. (2020, December). Libra rebrands to 'Diem' in anticipation of 2021 launch. Coindesk. <https://www.coindesk.com/libra-diem-rebrand>

Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar, S., Hess, J. (2018). The Global Findex database 2017, Chapter Six: Opportunities for expanding financial inclusion through digital technology. World Bank. https://globalfindex.worldbank.org/sites/globalfindex/files/chapters/2017%20Findex%20full%20report_chapter6.pdf

Dion-Schwarz, C., Manheim, D., Johnston, P. (2019). Terrorist use of cryptocurrencies: Technical and organizational barriers and future threats. RAND Corporation. https://www.rand.org/pubs/research_reports/RR3026.html

Dupas, P., Green, S., Keats, A., Robinson, J. (2016, September). African Successes, Volume III: Modernization and Development, Chapter Two: Challenges in banking the rural poor: evidence from Kenya's Western Province. University of Chicago. <https://www.nber.org/system/files/chapters/c13363/c13363.pdf>

El-Soghbi, M. (2016, January). What excludes women from formal finance in the Arab States? CGAP Blog. <https://www.cgap.org/blog/what-excludes-women-formal-finance-arab-states>

El-Zoghbi, M., Sourourian, M. (2019, July). Emerging evidence on financial inclusion. CGAP. <https://www.cgap.org/research/publication/emerging-evidence-financial-inclusion>

Fanusie, Y., Jin, E. (2021, January). China's digital currency: Adding financial data to digital authoritarianism. Center for New American Security (CNAS). <https://www.cnas.org/publications/reports/chinas-digital-currency>

Financial Crimes Enforcement Network (FinCEN). (2019, May). New FinCEN guidance affirms its longstanding regulatory framework for virtual currencies and a new FinCEN advisory warns of threats posed by virtual currency misuse. FinCEN News Release. <https://www.fincen.gov/news/news-releases/new-fincen-guidance-affirms-its-longstanding-regulatory-framework-virtual>

FinCEN. (2019, May). Advisory on illicit activity involving convertible virtual currencies. FinCEN Advisor No. 2019-A003. <https://www.fincen.gov/resources/advisories/fincen-advisory-fin-2019-a003>

Financial Stability Board (FSB). (2018, July). Crypto-assets: Report to the G20 on work by the FSB and standard-setting bodies. <https://www.fsb.org/wp-content/uploads/P160718-1.pdf>

FSB. (2020, April). Consultative document: Addressing the regulatory, supervisory and oversight challenges raised by 'global stablecoin' arrangements. <https://www.fsb.org/2020/04/addressing-the-regulatory-supervisory-and-oversight-challenges-raised-by-global-stablecoin-arrangements-consultative-document/>

FBI. (2019, February). Cryptocurrency fraudster sentenced. FBI Press Release. <https://www.fbi.gov/news/stories/cryptocurrency-fraudster-sentenced-021119>

FBI. (2020, April). FBI expects a rise in scams involving cryptocurrency related to the COVID-19 pandemic. FBI Press Release. <https://www.fbi.gov/news/pressrel/press-releases/fbi-expects-a-rise-in-scams-involving-cryptocurrency-related-to-the-covid-19-pandemic>

FATF. (2014, June). Virtual currencies: Key definitions and potential AML/CFT risks. <https://www.fatf-gafi.org/publications/methodsandtrends/documents/virtual-currency-definitions-aml-cft-risk.html>

FATF. (2019, June). Guidance for a risk-based approach: Virtual assets and virtual asset service providers. <https://www.fatf-gafi.org/publications/fatfrecommendations/documents/guidance-rba-virtual-assets.html>

FATF. (2020, July). 12 Month Review of Revised FATF Standards - Virtual Assets and VASPs. <http://www.fatf-gafi.org/publications/fatfrecommendations/documents/12-month-review-virtual-assets-vasps.html>

FATF. (2020, September). Virtual Assets Red Flag Indicators of Money Laundering and Terrorist Financing. <https://www.fatf-gafi.org/publications/methodsandtrends/documents/virtual-assets-red-flag-indicators.html>

FATF. (2021, July). Second 12-Month Review of Revised FATF Standards on Virtual Assets and Virtual Asset Service Providers. <https://www.fatf-gafi.org/publications/fatfrecommendations/documents/second-12-month-review-virtual-assets-vasps.html>

Finextra. (2016, February). Stellar builds instant money transfer network in Nigeria. <https://www.finextra.com/newsarticle/28428/stellar-builds-instant-money-transfer-network-in-nigeria>

G7 Working Group on Stablecoins. (2019, October). Investigating the impact of global stablecoins. G7, IMF, BIS CPML. <https://www.bis.org/cpmi/publ/d187.pdf>

Gladstein, A. (2019, January). Why Bitcoin matters for freedom. Human Rights Foundation. <https://hrf.org/why-bitcoin-matters-for-freedom/>

Greenspan, G. (2016, March). Blockchains vs centralized databases. MultiChain Blog. <https://www.multichain.com/blog/2016/03/blockchains-vs-centralized-databases/>

Greenspan, G. (2016, December). How to spot a half-baked blockchain. MultiChain Blog. <https://www.multichain.com/blog/2016/12/spot-half-baked-blockchain/>

Greenspan, G. (2017, May). The blockchain immutability myth. MultiChain Blog. <https://www.multichain.com/blog/2017/05/blockchain-immutability-myth/>

Greenspan, G. (2017, July). A rational take on cryptocurrencies. MultiChain Blog. <https://www.multichain.com/blog/2017/07/rational-take-cryptocurrencies/>

He, D., Habermeier, K., Leckow, R., Haksar, V., Almeida, Y., Kashima, M., Kyriakos-Saad, N., Oura, H., Sedik, T., Stetsenko, N., Yepes, C. (2016, January). Virtual currencies and beyond: Initial considerations. IMF Staff Discussion Note 16/03. <https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2016/12/31/Virtual-Currencies-and-Beyond-Initial-Considerations-43618>

Hertig, A. (2020, December). What is proof-of-stake? Coindesk. <https://www.coindesk.com/proof-of-stake>

International Organization of Securities Commissions (IOSCO-IOSCO). (2020, March). Global stablecoin initiatives. <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD650.pdf>

Jeffries, A. (2018, March). 'Blockchain' is meaningless: 'You keep using that word. I do not think it means what you think it means.' The Verge. <https://www.theverge.com/2018/3/7/17091766/blockchain-bitcoin-ethereum-cryptocurrency-meaning>

Kiff, J., Alwazir, J., Davidovic, S., Huertas, G., Khan, A., Khiaonang, T., Malaika, M., Monroe, H., Sugimoto, N., Tourpe, H., Zhou, P. (2020, June). A survey of research on retail central bank digital currency. IMF Working Paper No. 20/104. <https://www.imf.org/en/Publications/WP/Issues/2020/06/26/A-Survey-of-Research-on-Retail-Central-Bank-Digital-Currency-49517>

Kimani, M. (2021, February). China leads Africa's digital currency race. Coindesk Opinion. <https://www.coindesk.com/china-leads-africas-digital-currency-race>

Klapper, L., Singer, D. (2016, June). Financial inclusion and trust issues in Europe, Central Asia. Gallup Blog. <https://news.gallup.com/opinion/gallup/192722/financial-inclusion-trust-issues-europe-central-asia.aspx>

Ledger Insights. (2019, November). Ripple's blockchain cross-border payments network grows to 300. <https://www.ledgerinsights.com/ripple-blockchain-300-customers/>

Lee, M. (2020, April). Disruption and digital revolution for whom? Considerations on the use of blockchain and distributed ledger technology in displacement contexts. UN High Commissioner for Refugees (UNHCR). https://www.unhcr.org/innovation/wp-content/uploads/2020/05/Disruption-and-digital-revolution-for-whom_WEB052020.pdf

Library of Congress. (2018, June). Regulation of cryptocurrency in selected jurisdictions. <https://www.loc.gov/law/help/cryptocurrency/index.php>

Lwanda, G. (2019, June). Cryptocurrency could help Zimbabwe overcome its economic crisis. World Economic Forum and Project Syndicate. <https://www.weforum.org/agenda/2019/06/zimbabwe-needs-its-own-cryptocurrency/>

Lwanga-Ntale, C., Owino, B. (2020, September). Understanding vulnerability and resilience in Somalia. Journal of Disaster Risk Studies, 12(1): 856. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7768599/>

Manyika, J., Lund, S., Singer, M., White, O., Berry, C. (2016, September). Digital finance for all: Powering inclusive growth in emerging economies. McKinsey Global Institute. <https://www.findevgateway.org/paper/2016/09/digital-finance-all-powering-inclusive-growth-emerging-economies>

Mazer, R. (2014, December). Digital currencies and financial inclusion: 5 questions. CGAP Blog. <https://www.cgap.org/blog/digital-currencies-and-financial-inclusion-5-questions>

Moss, T., Pisa, M. (2021, April). Bitcoin mining is bad for the world: The limited options for addressing the problem. Center for Global Development Blog. <https://www.cgdev.org/blog/bitcoin-mining-bad-world-limited-options-addressing-problem>

Partnership for Finance in a Digital Africa. (2019, October). Evidence Gap Map. <https://egm.financedigitalafrica.org>

Popper, N. (2020, January). Bitcoin has lost steam. But criminals still love it. The New York Times. <https://www.nytimes.com/2020/01/28/technology/bitcoin-black-market.html>

Principles for Digital Development. <https://digitalprinciples.org/>

PYMNTS.com. (2019, September). Mastercard, R3 team up to bring blockchain to x-border payments. Blog. <https://www.pymnts.com/news/partnerships-acquisitions/2019/mastercard-r3-team-for-blockchain-cross-border-payments/>

Rauchs, M., Hileman, G. (2017). Global cryptocurrency benchmarking study. University of Cambridge Centre for Alternative Finance (CCAF) <https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/publications/global-cryptocurrency/>

Rauchs, M., Blandin, A., Klein, K., Pieters, G., Recanatini, M., Zhang, B. (2018, December). 2nd global cryptoasset benchmarking study. CCAF. <https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/publications/2nd-global-cryptoasset-benchmark-study/>

Rauchs, M., Glidden, A., Gordon, B., Pieters, G., Recanatini, M., Rostand, F., Vagneur, K., Zhang, B. (2018, August). Distributed ledger technology systems: a Conceptual framework. CCAF. <https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/publications/distributed-ledger-technology-systems/>

Rauchs, M., Blandin, A., Cloots, A., Hussain, H., Saleuddin, R., Allen, J., Cloud, K., Zhang, B. (2019). Global cryptoasset regulatory landscape study. CCAF. <https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/publications/cryptoasset-regulation/>

Rendon, M. (2018, February). How the blockchain can help Venezuela's future recovery. Center for Strategic and International Studies (CSIS) <https://www.csis.org/analysis/how-blockchain-can-help-venezuelas-future-recovery>

Rendon, M. (2018, September). Can cryptocurrency help Venezuela? CSIS. <https://www.csis.org/analysis/can-cryptocurrency-help-venezuela>

Rendon, M., Sanchez, L. (2020, September). Covid-19 in Venezuela: How the pandemic deepened a humanitarian crisis. CSIS. <https://www.csis.org/analysis/covid-19-venezuela-how-pandemic-deepened-humanitarian-crisis>

Renteria, N., Wilson, T., Strohecker, K. (2021, June). In a world first, El Salvador makes bitcoin legal tender. Reuters. <https://www.reuters.com/world/americas/el-salvador-approves-first-law-bitcoin-legal-tender-2021-06-09/>

Reuters Staff. (2020, August). U.S. unfreezing Venezuelan assets to help opposition fight COVID-19: Guaido. Reuters. <https://www.reuters.com/article/us-health-coronavirus-venezuela/u-s-unfreezing-venezuelan-assets-to-help-opposition-fight-covid-19-guaido-idUSKBN25H0FB>

Securities and Exchange Commission (SEC). (2019, April). Framework for "investment contract" analysis of digital assets. <https://www.sec.gov/corpfin/framework-investment-contract-analysis-digital-assets>

Segal, S., Risberg, P. (2020, December). Central bank digital currency, design choices, and impacts on currency internationalization. CSIS Brief. <https://www.csis.org/analysis/central-bank-digital-currency-design-choices-and-impacts-currency-internationalization>

Silversten, E., Favaro, M., Slapokova, L., Sascha, I., Liu, J., Salas, A. (2020). Exploring the use of Zcash cryptocurrency for illicit or criminal purposes. RAND Corporation. https://www.rand.org/pubs/research_reports/RR4418.html

Swanson, T. (2015, April). Consensus-as-a-service: a Brief report on the emergence of permissioned, distributed ledger systems. <http://www.ofnumbers.com/wp-content/uploads/2015/04/Permissioned-distributed-ledgers.pdf>

Swanson, T. (2019, October). Have PoW blockchains become less resource intensive? Of Numbers Blog. <https://www.ofnumbers.com/2019/10/15/have-pow-blockchains-become-less-resource-intensive/>

Vigna, P. (2021, February). Why Bitcoin hasn't gained traction as a form of payment. Wall Street Journal. <https://www.wsj.com/articles/why-bitcoin-hasnt-gained-traction-as-a-form-of-payment-11612886974>

Walch, A. (2017, March). The path of the blockchain lexicon (and the law). 36 Review of Banking & Financial Law 713. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2940335

Wilson, T., Schroeder, P. (2021, May). Facebook-backed crypto project Diem to launch U.S. stablecoin in major shift. Reuters. <https://www.reuters.com/technology/facebook-backed-crypto-project-diem-launch-us-stablecoin-major-shift-2021-05-12/>

World Bank. (2018, May). Cryptocurrencies and blockchain. Europe and Central Asia Economic Update. <https://documents1.worldbank.org/curated/en/293821525702130886/pdf/Cryptocurrencies-and-blockchain.pdf>